LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

Absorption of the Radio-active Emanations by Charcoal.

THE interesting property of certain kinds of charcoal, notably that of the cocoa-nut, of rapidly absorbing gases, except the inert gases belonging to the argon family, is now well known since the recent experiments of Sir James Dewar.

In a recent investigation I had occasion to pass the radium emanation through a tube filled with cocoa-nut charcoal, and was surprised to find that the emanation was completely absorbed by it. If a slow current of air, mixed with the emanation of radium, thorium, or actinium, is passed through a tube filled with charcoal, the issuing gas is completely deprived of emanation. This occurs at ordinary temperatures, and there is no necessity for initial cooling of the charcoal. This property of charcoal of absorbing the radium emanation can be shown by a very simple and striking experiment. If a side tube containing a fraction of a gram of charcoal is attached to a vessel containing the emanation released from several milligrams of radium bromide, in the course of time the emanation is absorbed by the charcoal. At ordinary temperatures, several hours or days, depending on the size of the vessel, are required to effect a complete absorption as the emanation diffuses slowly through the air. If some powdered willemite is added with the charcoal, the gradual absorption of the emanation is shown by the increasing brilliancy of the phosphorescence produced in the surrounding willemite.

It makes no difference whether the charcoal has been initially heated to get rid of the absorbed air or whether it has already absorbed its full quantity. At low pressures of the gas, using charcoal which has been previously heated, the removal of the emanation takes place rapidly. This is probably due to the rapid absorption of the gas which carries the emanation with it. The charcoal retains the emanation at ordinary temperatures, for I have found that the emanation retained in a charcoal tube open to the air loses its activity at the normal rate observed in sealed vessels.

The greater part of the emanation is released by heating the charcoal below a red heat. I have not yet settled whether the release of the emanation is due to an alteration in the absorptive power of the charcoal for the emanation at high temperatures, or whether the emanation is mechanically carried away by the rush of air which takes place when the charcoal is heated.

Since the emanations behave like inert gases of the argon family, it is somewhat surprising that charcoal should so readily absorb them. It must be remembered, however, that in ordinary experiments a very minute quantity of the emanation is present, and it is not unlikely that even the gases argon and helium are absorbed by charcoal to a small degree.

This property of charcoal of retaining the emanation promises to be of service in laboratories where radium is kept in a state of solution. It is dangerous to keep radium in the form of solution in sealed vessels, as the gradual production of hydrogen and oxygen in the solution raises the internal pressure, which would ultimately lead to the bursting of the vessel. At the same time, the escape of the emanation causes a radio-active contamination of the laboratory which renders delicate experiments on radio-activity or ionisation very difficult.

This problem will be solved by the use of a small tube containing cocoa-nut charcoal attached to the vessel, with one end open to the air. The air inside the radium vessel is kept at atmospheric pressure, while the emanation is completely stopped in the charcoal. The emanation mixed with a small quantity of gas can at any time be obtained from the charcoal by heating.

Experiments are in progress to test whether this property of charcoal can be utilised to determine quantitatively the amount of radium emanation existing in the air, and also the amount of emanation diffusing to the atmosphere from the soil.

E. RUTHERFORD.

McGill University, Montreal, October 6.

The Recent Radium Controversy.

I WAS absent from Montreal during the time of the interesting discussion on radium which appeared in the *Times*, and it is only quite recently that I have had an opportunity of reading the correspondence in full. In the course of this discussion some weight has been attached to a remark in the second edition of my book "Radio-activity," viz. that radium is a compound of helium and lead. It is far from my intention to reopen this discussion, on which I think quite enough has already been said, but in the last issue of NATURE (September 27) which I have just received, there appears a letter by Lord Kelvin in which this remark is still further emphasised.

Lord Kelvin quite correctly quotes my words, but I feel that the statement, apart from its context, is liable to leave an erroneous impression of my views on the question, especially in the minds of those who are not directly acquainted with my writings.

At the risk of being somewhat lengthy, I should like to quote fully some statements made in my book which, I think, clearly show my attitude on this question.

V. p. 482 :—"In order to explain the presence of helium in radium on ordinary chemical lines, it has been suggested that radium is not a true element, but a molecular compound of helium with some substance known or unknown. The helium composed gradually breaks down, giving rise to the helium observed. It is at once obvious that this postulated helium compound is of a character entirely different from that of any other compound previously observed in chemistry. Weight for weight, it emits during its change an amount of energy at least one million times greater than any molecular compound known (see section 249). In addition it must be supposed that the rate of breaking up of the helium compound is independent of great ranges of temperature—a result never before observed in any molecular change. The helium compound in its breaking up must give rise to the peculiar radiations and also pass through the successive radio-active changes observed in radium.

"Thus in order to explain the production of helium and radio-activity on this view, a unique kind of molecule must be postulated—a molecule in fact which is endowed with every single property which on the disintegration theory is ascribed to the atom of the radio-elements. On the other hand, radium, as far as it has been examined, has fulfilled every test required for an element. It has a well marked and characteristic spectrum, and there is no reason to suppose that it is not an element in the ordinarily accepted sense of the term.

"On the theory that the radio-elements are undergoing atomic disintegration, the helium must be considered to be a constituent of the radium atom, or in other words, the radium atom is built up of parts, one of which, at least, is the atom of helium. . . ."

P. 483 :—"Taking the view that the α particles are projected helium atoms, we must regard the atoms of the radio-elements as compounds of some known or unknown substance with helium. These compounds break up spontaneously, and at a very slow rate even in the case of radium. The disintegration takes place in successive stages, and at most of the stages a helium atom is projected with great velocity. This disintegration is accompanied by an enormous emission of energy. The liberation of such a large amount of energy in the radio-active changes at once explains the constancy of the rate of change under the action of any of the physical and chemical agencies at our command. On this view, uranium, thorium, and radium are in reality compounds of helium. The helium, however, is held in such strong combination that the compound cannot be broken up by chemical or physical forces, and, in consequence, these bodies behave as chemical elements in the ordinarily accepted chemical sense.